CLAIMS

WHAT IS CLAIMED:

1. A fuel cell maintenance device, comprising:
a switch; and
a pulse generator capable of pulsing a cathode of at least one cell of a fuel cell stack through the switch when the switch is closed.

2. The fuel cell maintenance device of claim 1, wherein the switch comprises:
a relay capable of shorting the cell of a fuel cell stack; and
a dielectrically isolated driver capable of driving the relay.

3. The fuel cell maintenance device of claim 2, wherein the relay comprises a solid-state relay.

4. The fuel cell maintenance device of claim 2, wherein the relay is further capable of shorting a second cell of the fuel cell stack.

5. The fuel cell maintenance device of claim 1, further comprising:
a second switch through which the pulse generator is capable of pulsing a cathode of a second cell when the second switch is closed; and
a control circuit capable of controlling to which of the first and second relays the pulse generator output is transmitted.

6. The fuel cell maintenance device of claim 5, wherein the second switch includes:
a second relay capable of shorting at least a second cell of a fuel cell stack; and
a second dielectrically isolated driver capable of driving a second relay responsive to the pulse generator output.

7. The fuel cell maintenance device of claim 6, wherein at least one of the first relay and the second relay is further capable of shorting one of a third cell and a fourth cell of the fuel cell stack.

8. The fuel cell maintenance device of claim 1, wherein at least one of the switch and the pulse generator is capable of receiving power returned from the fuel cell stack.

9. The fuel cell maintenance device of claim 8, further comprising a voltage regulator coupled to at least one of the switch and the pulse generator and configured to receive the power returned from the fuel cell stack.

10. The fuel cell maintenance device of claim 1, wherein the pulse generator is capable of pulsing a cathode of a second cell when the switch is closed.

11. A fuel cell maintenance device, comprising:

at least one relay capable of shorting at least one cell of a fuel cell stack;

a dielectrically isolated driver capable of driving the relay; and

a pulse generator capable of pulsing a cathode of the cell through the relay when the dielectrically isolated driver closes the relay to short the cell.

12. The fuel cell maintenance device of claim 11, wherein the relay comprises a solid-state relay.

13. The fuel cell maintenance device of claim 11, wherein the relay is further capable of shorting a second cell of the fuel cell stack.

14. The fuel cell maintenance device of claim 11, further comprising:

a second relay capable of shorting at least a second cell of a fuel cell stack;

a second dielectrically isolated driver capable of driving second relay responsive to the pulse generator output; and

a control circuit capable of controlling to which of the first and second relays the pulse generator output is transmitted.

15. The fuel cell maintenance device of claim 14, wherein at least one of the first relay and the second relay is further capable of shorting one of a third cell and a fourth cell of the fuel cell stack.

16. The fuel cell maintenance device of claim 11, wherein at least one of the relay, the dielectrically isolated driver and the pulse generator is capable of receiving power returned from the fuel cell stack.

17. The fuel cell maintenance device of claim 16, further comprising a voltage regulator through which at least one of the relay, the dielectrically isolated driver and the pulse generator is capable of receiving power returned from the fuel cell stack.

18. The fuel cell maintenance device of claim 11, wherein the pulse generator is capable of pulsing a cathode of a second cell through the relay when the dielectrically isolated driver closes the relay to short the cell.

19. A fuel cell maintenance device for a fuel stack including at least one fuel cell, the fuel cell maintenance device comprising:

at least one relay electrically connected in parallel across the cell;

a dielectrically isolated driver operably associated with the relay to drive the relay; and

a pulse generator electrically connected to the dielectrically isolated driver to pulse a cathode of the cell through the relay when the dielectrically isolated driver closes the relay.

20. The fuel cell maintenance device of claim 19, wherein the relay comprises a solid-state relay.

21. The fuel cell maintenance device of claim 19, wherein the relay is further electrically connected in parallel across a second cell of the fuel cell stack.

22. The fuel cell maintenance device of claim 19, further comprising:

a second relay electrically connected in parallel across a second cell of a fuel cell stack;

a second dielectrically isolated driver capable of driving second relay responsive to the pulse generator output; and

a control circuit capable of controlling to which of the first and second relays the pulse generator output is transmitted.

23. The fuel cell maintenance device of claim 22, wherein at least one of the first relay and the second relay is further electrically connected in parallel across one of a third cell and a fourth cell of the fuel cell stack.

24. The fuel cell maintenance device of claim 19, further comprising a power return from the fuel cell stack to at least one of the pulse generator, the relay and dielectrically isolated driver.

25. The fuel cell maintenance device of claim 24, wherein the power return includes a voltage regulator.

26. The fuel cell maintenance device of claim 19, wherein:
the relay is electrically connected in parallel across a second cell; and
the pulse generator is electrically connected to the dielectrically isolated driver to pulse a cathode of the second cell through the relay when the dielectrically isolated driver closes the relay.

27. An apparatus, comprising:
a fuel stack, including a plurality of cells;
a switch bank, including a plurality of switches, each switch electrically connected in parallel across at least one of the cells;
a pulse generator capable of pulsing the cathodes of the cells when the respective switch is closed; and
a control circuit electrically connected in series between the pulse generator and the switch bank to sequentially open and close the switches.

28. The apparatus of claim 27, wherein each switch comprises:
a relay capable of shorting at least one cell of a fuel cell stack; and
a dielectrically isolated driver capable of driving the relay.

29. The apparatus of claim 28, wherein the relay comprises a solid-state relay.

30. The apparatus of claim 28, wherein the relay is further capable of shorting a second cell of the fuel cell stack.

31. The apparatus of claim 27, wherein each switch is capable of shorting a plurality of cells.

32. The apparatus of claim 27, wherein at least one of the switch bank and the pulse generator is capable of receiving power returned from the fuel cell stack.

33. The apparatus of claim 32, further comprising a voltage regulator through which at least one of the switch bank and the pulse generator is capable of receiving power returned from the fuel cell stack.

34. The apparatus of claim 27, wherein the cells are proton exchange membrane fuel cells.

35. The apparatus of claim 27, wherein control circuit includes:
a counter driven by a clock; and
a multiplexer multiplexing the output of the pulse generator to the switches responsive to the count of the counter.

36. A method for transparently maintaining the cells of a fuel cell stack, the method comprising:
sequentially pulsing the cathodes of a plurality of cells in a fuel cell stack; and
maintaining a consistent number of the cells providing power to a load of the fuel cell stack while sequentially pulsing the cathodes of the cells.

37. The method of claim 36, wherein pulsing the cathodes includes:
generating a pulse train; and
sequentially supplying the pulse train to the cells.

38. The method of claim 37, wherein sequentially supplying the pulse train to the cells includes:
supplying the pulse train to a first cell of the fuel cell stack to pulse a cathode thereof; and
switching the supply of the pulse train from the first cell to a second cell of the fuel stack to pulse a cathode thereof.

39. The method of claim 36, wherein sequentially pulsing the cathodes of the cells includes:
supplying the pulse train to a first cell of the fuel cell stack to pulse a cathode thereof; and
switching the supply of the pulse train from the first cell to a second cell of the fuel stack to pulse a cathode thereof.

40. A method for transparently maintaining the cells of a fuel cell stack, the method comprising:

generating a pulse train;

supplying the pulse train to a first cell of the fuel cell stack to pulse a cathode thereof; and

switching the supply of the pulse train from the first cell to a second cell of the fuel stack to pulse a cathode thereof.

41. The method of claim 40, wherein supplying the pulse train to the first cell includes counting the pulses in the pulse train and switching the supply includes switching the supply responsive to the count.

42. The method of claim 40, wherein:

supplying the pulse train to the first cell to pulse the cathode thereof includes supplying the pulse train to a first pair of cells of the fuel cell stack, the first pair including the first cell, to pulse the cathodes thereof; and

switching the supply of the pulse train from the first cell to the second cell of the fuel stack to pulse the cathode thereof includes switching the supply of the pulse train from the first pair of cells to a second pair of cells, the second pair of cells including the second cell, to pulse the cathodes thereof.

43. A fuel cell maintenance device, comprising:

means for imposing a low impedance across at least one cell of a fuel cell stack; and

a pulse generator capable of pulsing a cathode of the at least one cell of through the low impedance imposing means.

44. The fuel cell maintenance device of claim 43, wherein the low impedance imposing means includes a switch that imposes the low impedance when closed and receiving a pulse from the pulse generator.

45. The fuel cell maintenance device of claim 44, wherein the switch comprises:

a relay capable of shorting the cell of a fuel cell stack; and

a dielectrically isolated driver capable of driving the relay.

46. The fuel cell maintenance device of claim 45, wherein the relay comprises a solid-state relay.

47. The fuel cell maintenance device of claim 45, wherein the relay is further capable of shorting a second cell of the fuel cell stack.

48. The fuel cell maintenance device of claim 43, further comprising:

second means for imposing a low impedance across at least a second cell of a fuel cell stack; and

a control circuit capable of controlling to which of the first and second low impedance imposing means the pulse generator output is transmitted.

49. The fuel cell maintenance device of claim 48, wherein the second low impedance imposing means includes a second switch that imposes the low impedance when closed and receiving a pulse from the pulse generator.

50. The fuel cell maintenance device of claim 49, wherein the second switch includes:

a second relay capable of shorting at least a second cell of a fuel cell stack; and

a second dielectrically isolated driver capable of driving a second relay responsive to the pulse generator output.

51. The fuel cell maintenance device of claim 50, wherein at least one of the first relay and the second relay is further capable of shorting one of a third cell and a fourth cell of the fuel cell stack.

52. The fuel cell maintenance device of claim 43, wherein at least one of the low impedance imposing means and the pulse generator is capable of receiving power returned from the fuel cell stack.

53. The fuel cell maintenance device of claim 52, further comprising a voltage regulator coupled to at least one of the switch and the pulse generator and configured to receive the power returned from the fuel cell stack.

54. The fuel cell maintenance device of claim 43, wherein the pulse generator is capable of pulsing a cathode of a second cell through the low impedance imposing means.